

WHAT IS CLAIMED IS:

1. An inexpensive and programmable amplitude and phase shifting circuit comprising:
 - an enclosure comprising:
 - means for holding printed circuit boards; and
 - a front panel for receiving input and output signals;
 - a motherboard comprising:
 - means for supplying input signals through said front panel;
 - a power source;
 - digital control lines; and
 - a demultiplexer circuit board;
 - said demultiplexer circuit board within said motherboard comprising:
 - a plurality of signal receiving digital control lines from a digital output card in a personal computer;
 - a plurality of signal sending digital control lines routed to an amplitude/phase shifting circuit board; and
 - means for selecting a single amplifier for operator selected amplitude or phase gain change;
 - an amplitude/phase shifting circuit board comprising:
 - a plurality of programmable gain operational amplifiers, one amplifier selected at a time to have its gain changed when an operator desires a new amplitude or phase; and
 - a plurality of signal receiving digital control lines for receiving output lines from said demultiplexer, each of said digital control lines connected to a different multiplying operational amplifier chip select line on said amplitude/phase shifting circuit board; and
 - means for controlling said amplitude/phase shifting circuit.
2. The amplitude and phase shifting circuit of claim 1 wherein said enclosure further comprises a front panel for receiving sine and cosine input signals and phase shifted output signals.

3. The amplitude and phase shifting circuit of claim 1 wherein said enclosure mounts onto a standard electronics rack.

4. The amplitude and phase shifting circuit of claim 1 wherein said demultiplexer further comprises a 50-pin ribbon cable connector for accepting digital control lines coming from digital output card in a personal computer.

5. The amplitude and phase shifting circuit of claim 1 wherein said means for controlling said amplitude/phase shifting circuit comprises a digital output card from a personal computer.

6. The amplitude and phase shifting circuit of claim 5 wherein said digital output card interfaces with said amplitude/phase shifting circuit through a 50-pin ribbon cable.

7. The amplitude and phase shifting circuit of claim 5 wherein an operator interfaces with said digital output card through software.

8. The amplitude and phase shifting circuit of claim 7 wherein an operator interfaces with said digital output card through LabVIEW™ software.

9. An inexpensive, programmable, multiple channel amplitude and phase shifting method comprising the steps of:

inputting sine and cosine signal waveforms to two programmable gain operational amplifiers on an amplitude/phase shifting circuit board;

summing said outputs of said two programmable gain operational amplifiers using one summing operational amplifier on said amplitude/phase shifting circuit board;

implementing four channels of said inputting and summing steps on said amplitude/phase shifting circuit board, each of said channels connected to a demultiplexer circuit board;

powering said demultiplexer circuit board and said amplitude/phase shifting circuit boards through a motherboard;

selecting one of said four channels for a gain change through said demultiplexer circuit board;

controlling said programmable, multiple channel amplitude and phase shifting circuit; and

sending an amplitude and phase shifted sinusoidal signal waveform to an output line interfacing with an panel on an enclosure containing said motherboard, said demultiplexer circuit board and said amplitude/phase shifting circuit board.

10. The inexpensive, programmable, multiple channel amplitude and phase shifting method of claim 9 wherein said providing step further comprises providing sine and cosine signal waveforms using a standard two-channel function generator.

11. The inexpensive, programmable, multiple channel amplitude and phase shifting method of claim 9 wherein said controlling step further comprises controlling said programmable, multiple channel amplitude and phase shifting circuit using a digital output card from a personal computer.

12. The inexpensive, programmable, multiple channel amplitude and phase shifting method of claim 11 wherein said controlling step further comprises
controlling said programmable, multiple channel amplitude and phase shifting circuit using a digital output card from a personal computer; and
operator interfacing with said digital output card with software.

13. The inexpensive, programmable, multiple channel amplitude and phase shifting method of claim 12 wherein said operator interfacing step further comprises operator interfacing with said digital output card using LabVIEW™ software.

14. The inexpensive, programmable, multiple channel amplitude and phase shifting method of claim 12 wherein said controlling step further comprises the step of

providing said demultiplexer circuit board with a 50-pin ribbon cable connector for accepting digital control lines coming from said digital output card in a personal computer.

15. The inexpensive, programmable, multiple channel amplitude and phase shifting method of claim 9 wherein said selecting step further comprises the steps of:
determining timing and sequence of reading data lines from said motherboard;
storing data in a buffer; and
changing gain of a selected operational amplifier.

16. The inexpensive, programmable, multiple channel amplitude and phase shifting method of claim 9 wherein said inputting step further comprises inputting sine and cosine signal waveforms to two programmable gain operational amplifiers on an amplitude/phase shifting circuit board through a motherboard.